Abstract

The *R2120 Appliance Recycling Study* had the following objectives:

- To estimate gross and net energy savings resulting from the recycling of refrigerators and freezers through the Energize Connecticut Appliance Recycling Program in 2020
- What participants think they would have done with the appliances at various incentives levels (including having to pay to have the unit removed)
- The importance of incentives relative to other benefits, including the reclamation of refrigerants and other materials, energy savings, and ease of removal
- To estimate the amount of materials reclaimed from appliances recycled in 2020 that could be attributed to program activity

The study makes the following recommendations:

- The study recommends that the utilities adopt the PSD updates listed below:
  - **Refrigerators:** Gross Savings = 932 kWh, Realization Rate = 0.90, NTG Ratio = 0.37
  - **Freezers**: Gross Savings = 760 kWh, Realization Rates = 0.83, NTG Ratio = 0.38
- The program should keep the incentive at $30 but also offer special offers at higher incentive levels.
- Should the program decide to permanently raise incentives, the NTG ratio should be raised to match those in Massachusetts and Rhode Island: 46% for refrigerators and 50% for freezers.
- Although the program does not currently account for non-energy impacts, the study suggests that 40% of the materials reclaimed or recycled can be directly attributed to program efforts.

To arrive at these recommendations, the study found the following:

Program Savings: Gross saving are comparable between Connecticut and Massachusetts, but the NTG ratio is lower Connecticut than in Massachusetts. This may reflect the lower incentive paid in Connecticut ($30 to $60) compared to Massachusetts ($75). The gross savings and realization rate estimates reflected the application of recent study results from Massachusetts to the characteristics of appliances recycled in Connecticut in 2020. The study calculated net savings based on survey responses of Connecticut participants.

Incentives: The study results did not provide clear guidance on the optimal incentive level. Many participants seemed willing to take part without an incentive. However, the program convinced more people to get rid of a unit they would have otherwise kept when they temporarily offered a $60 incentive over the typical $30 one.

Attribution of Recycled Materials: Survey responses from Connecticut participants suggests that the program caused 40% of the total amount of materials reclaimed and recycled by the program. The program reclaims ozone-depleting refrigerants and other hazardous materials It also recycles glass, plastic, and metals contained in recycled appliances. Yet, some of the appliances would likely have been recycled outside of the program. Therefore, the program should only claim the portion of materials it directly causes to be recycled.

MEMORANDUM

To: Connecticut EEB; Lisa Skumatz, Robert Wirtshafter, and Ralph Prahl, EEB Evaluation Administrators

From: Lisa Wilson-Wright, Shirley Pon, and Christine Smaglia, NMR

Date: October 26, 2021

Re: R2120 Appliance Recycling Incentives Research

This memo summarizes research on the degree to which incentive levels influence the Energize Connecticut Appliance Recycling Program and similar recycling programs in neighboring Massachusetts and Rhode Island. The study explores:

- Whether participants would have still taken part in the program if the incentive was lower or if they had to pay to take part
- How important incentives are to program participation relative to other drivers
- What would likely have happened to the appliances if they had not been recycled through the program, including any variations by incentive level
- What implications do alternative appliance outcomes have on net-to-gross (NTG) ratios and the attribution of reclaimed materials (e.g., refrigerants, glass, metals) in Connecticut

The Connecticut Energy Efficiency Board (EEB) and National Grid Rhode Island partnered on this study. The study builds from prior work conducted in Massachusetts,[1] and this memo compares results across the states whenever possible. An earlier memo summarized gross program savings and provided a preliminary estimate of net savings based on recently completed research in Massachusetts.

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[1] NMR. 2021. MA20X03-E-ARNTG *Appliance Recycling Net-to-Gross* https://ma-eeac.org/wp-content/uploads/MA-20X03-E-Appliance-Recycling-NTGReport_FINAL_2021.07.23-clean.pdf. Guidehouse. 2021. MA21R33-E-ARI *Appliance Recycling Impact Study* https://ma-eeac.org/wp-content/uploads/MA21R33-E-ARI-Appliance-Recycling-2019-Impact-Report_FINAL_01Sep2021.pdf.

Table 1 lists the critical recommendations related to PSD updates. The Recommendations section below provides additional recommendations and guidance for future research.

Table 1: Current and Recommended PSD Values

Savings Input	Refrigerator		Freezer	
	Current	Recommended	Current	Recommended
Gross Savings (kWh)	794	932	846	760
Realization Rates	1.00	0.90	1.00	0.83
NTG Ratios[1]	**0.69**	**0.37**	**0.59**	**0.38**

[1] **The PSD lists the free-ridership rate, which is 1 - NTG.**

Program Descriptions

The Connecticut Appliance Recycling Program started in 2020. Participants receive an incentive to have their unwanted freezer or refrigerator picked up from inside their homes by the program implementer, ARCA. The incentive is typically $30, but the program offered $60 for part of 2020 when participants were responsible for moving their unit outside of their home for contactless pickup during the international health crisis for safety reasons. If participants were unable to remove the unit from their home, they were placed on a waitlist until ARCA reinstated in-home pickups. Waitlisted customers also received the $60 incentive. The program recycled 740 units (135 freezers and 605 refrigerators) in 2020.

National Grid launched the Rhode Island Appliance Recycling Program in 2017. While the program operates the same as in Connecticut, Rhode Island participants receive a $50 incentive for having their unwanted freezer or refrigerator picked up from inside customers' homes. The incentive was raised to $125 during the contactless pick-up period of 2020. The Rhode Island program recycled 7,220 (630 freezers and 6,590 refrigerators) in 2019 and 2020.

Study Approach

The study explored the following objectives:

- What participants think they would have done with the appliances at various incentives levels (including having to pay to have the unit removed)
- The importance of incentives relative to other benefits, including the reclamation of refrigerants and other materials, energy savings, and ease of removal

To do so, a participant survey was fielded with 310 participants in Connecticut (243 refrigerator and 67 freezer recyclers) and 278 participants in Rhode Island (242 refrigerator and 36 freezer recyclers). Participants answered questions about their likelihood to have participated if the program had offered a lower or no incentive, the importance of the incentive and other benefits to their decision to participate, and what they think they would have done with the appliance had they not recycled it through the program.

Statistical modeling provided insights into optimal incentive levels for inducing program participation. The study also compared survey data from Connecticut, Massachusetts, and Rhode Island to provide additional information on optimal incentive levels. The analysis yielded a NTG

ratio estimate and a recycling attribution percentage based on the responses of what Connecticut participants think they would have done with the unit had they not recycled it through the program. The study applied the NTG ratio to gross savings estimates presented in an earlier memo and the attribution percentage to information ARCA provided on materials reclaimed by the program in 2020.

See Appendix A for more detail on the study methods.

Findings

This section presents the key findings stemming from the participant survey research.

INCENTIVES EXPLORATION

The statistical modeling results and survey responses do not present a clear signal as to whether the utilities should change their current incentive or by how much. The statistical model and some survey questions suggest that participants are willing to accept incentive reductions. Other results point to maintaining or increasing incentives. Two factors likely explain the conflicting results:

- The study only examined participants who had already received an incentive, which may bias their answers about willingness to accept (WTA) a lower incentive.
- Many of the participants received a larger incentive due to contactless pickup procedures, but the scenario described both accepting lower incentives and in-home pickup.

This section presents the results of the incentive exploration.

Predicted Incentives. The model predicted the optimal acceptable incentive reduction (i.e., change in incentive) to be $58 in Connecticut and $84 in Rhode Island (Table 2).[2] These reflect the predicted depth of reduction at which 50% of participants would no longer take part in the program relative to the original incentive respondents received. The acceptable reductions exceed current incentives ($30 in Connecticut and $50 in Rhode Island) because so many survey respondents originally received the higher contactless period incentives ($60 in Connecticut and $125 in Rhode Island).

Table 2: Willingness to Accept Incentive Reduction (n = 541)[1]

	Connecticut	Rhode Island
WTA	$58 ($49, $70)	$84 ($73, $98)

[1] Confidence intervals in parentheses.

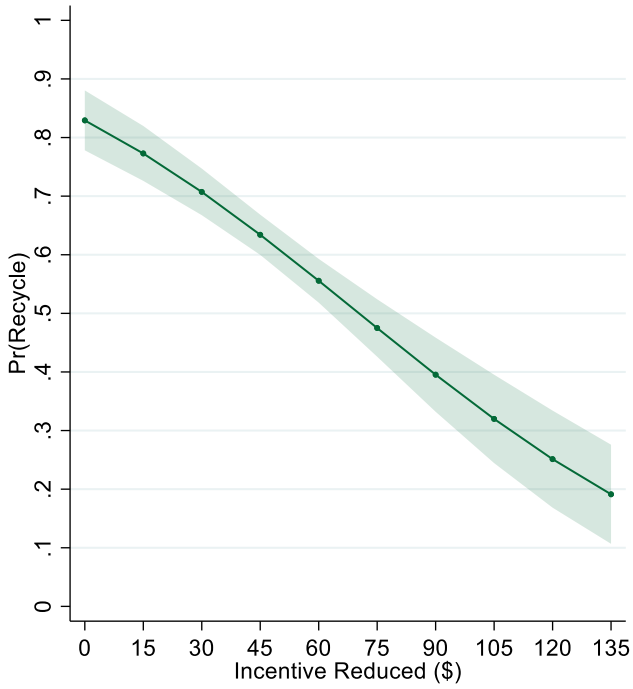
Figure 1 graphs the model results to show how the predicted likelihood of participation decreases the more the incentive is reduced.[3] For example, without any changes to the incentive, the probability of participation among the eligible population is 83%. If the incentive is reduced by

[2] The study relied on a probit model.
[3] The model uses survey responses to attempt to predict behavior in the broader population. Here, “eligible” means customers have an appliance to recycle and are aware of the program.

$30, the probability of participation declines to 71%. In other words, reducing the average incentive by $30 results in a 14% decline in participation. The nonlinear nature of the probit model allows for the relationship between the incentive reduction and probability of participation to vary at different points as opposed to a linear model. Additional results from a sensitivity analysis can be found in Figure 11 in Appendix B.2.

The model predicted WTA reduction amounts that exceed the incentives that the programs currently offer. The predicted reduction in Connecticut is essentially equal to the incentive paid during the contactless period. Recognizing the clear shortcomings of this approach, the study considered other information when drawing conclusions about optimal incentives.

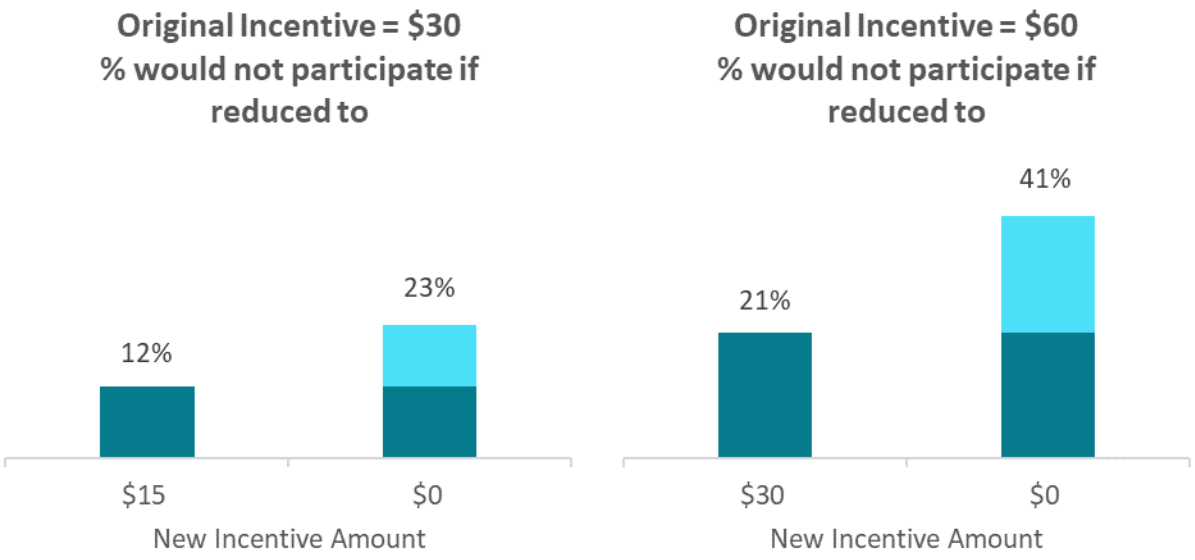
Figure 1: Probability of Program Participation by Reduction in Incentive



[1] Shaded region depicts the confidence intervals.

Changes in Participation Level at Lower Incentives. Figure 2 presents the predicted percentage of the eligible population that would decline participation at different incentive levels. For example, the model predicted that lowering a $60 incentive to $30 would reduce participation in the eligible population by 21%. The model also predicted that removing the incentive entirely would reduce participation by 41% among eligible customers. These results make two things clear: (1) the starting point (or *anchor*) matters: as households that received a larger incentive are less likely to accept a specific lower incentive amount (e.g., $30) than households that initially received a smaller incentive,[4] and (2) some participants are willing to accept a lower incentive. This acceptance may reflect the influence of other program drivers.

Figure 2: Predicted Reduction in Program Participation at Lower Incentives, Connecticut[1]



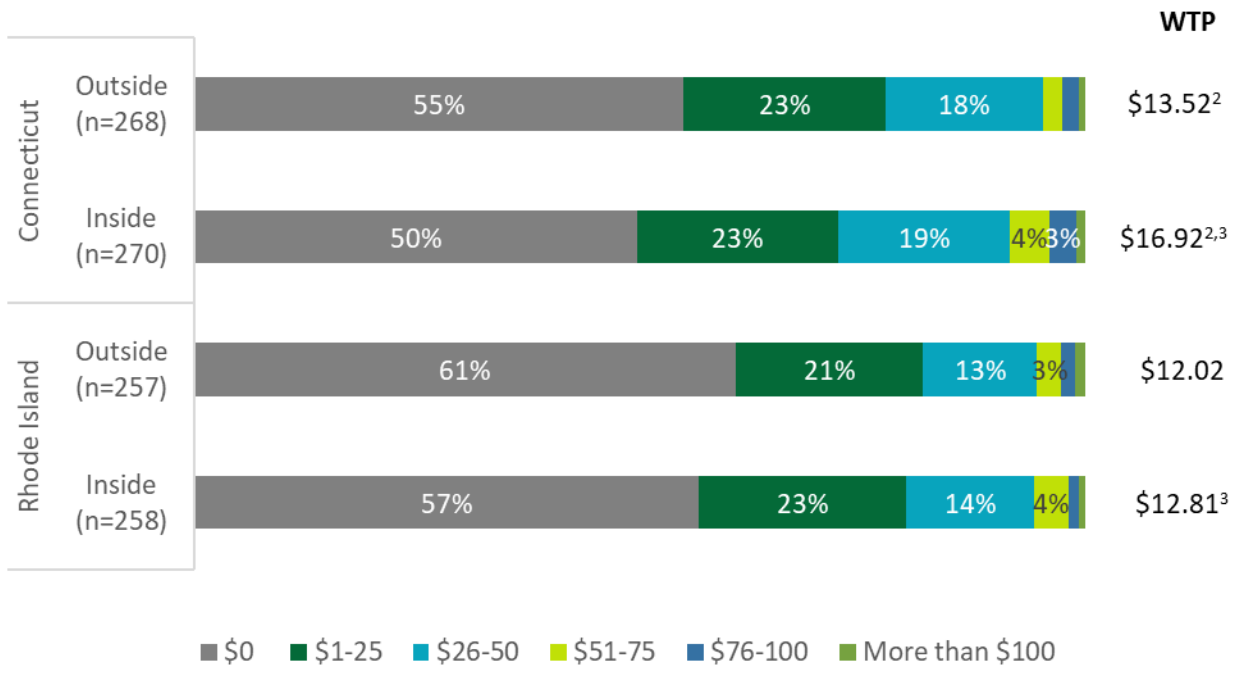
[1] Each bar shows the cumulative percent of respondents that the model predicts would not participate at the stated incentive level. For example, the model predicts that 12% of respondents who received the $30 incentive would not have participated if the incentive was reduced to $15. The bar directly to the right shows that an additional 11% of respondents – 23% in total – would not have participated if the incentive was reduced to $0.

[4] For a rational consumer, the anchoring (or starting point) should not matter. However, behavioral economics experiments repeatedly show the existence of anchoring bias. The process people go through is called "anchoring and adjustment." People start with some anchor, a number that they know (here, the incentive they received) and adjust it in the direction they think appropriate to estimate something's value. The behavioral experiments show that these adjustments are typically insufficient: people starting with a higher anchor estimate it high and people starting with a low anchor estimate it low, resulting in anchoring bias. Here, the anchors of the actual incentives that respondents received nudged them in a particular direction. This is consistent with the behavioral economics literature on nudging as well as anchoring bias.

Results from a direct analysis of the survey responses further support the modeled findings discussed above. Approximately 50% of the respondents asked (52% of those asked in Connecticut and 46% of those asked in Rhode Island) said that they would have participated even without an incentive. The survey randomly assigned respondents an alternative incentive amount that fell between $0 and the incentive they received. Fifty-four percent of Connecticut and 35% of Rhode Island respondents were asked if they would participate in the program if the incentive was lowered to $0. Due to random assignment, the other respondents would likely have answered similarly if asked if they would have participated with no incentive.

Most respondents in both Connecticut and Rhode Island would be unwilling to pay to have their refrigerator or freezer picked up either inside (50% in Connecticut, 57% in Rhode Island) or outside (55% in Connecticut, 61% in Rhode Island) of their home (Figure 3).

Figure 3: Willingness to Pay to have Appliance Removed or Recycled by State and Pick up Mode[1]



[1] Excludes "Don't Know" responses.
[2] Difference in WTP values for inside pick up and outside pick up are statistically significant at the 90% confidence level.
[3] Difference in Connecticut and Rhode Island WTP values are statistically significant at the 90% confidence level.

Relative Importance of Program Benefits

Figure 4 shows that 61% of Connecticut respondents indicated that incentives played a role in their decision to participate in the program. Among those who said that incentives played a role, 45% named the incentive as the most important factor. Overall, 23% of Connecticut respondents named the incentive as the most important factor. Rhode Island respondents were more likely than Connecticut respondents to name the incentive as the most important factor, which may reflect the higher incentives paid in Rhode Island. Appendix B.2 summarizes the importance of incentives by product, pickup location, and incentive level.

Figure 4: Importance of Incentive in Decision to Participate in the Program by State

	Connecticut	Rhode Island
Incentives played a role (of all respondents)	61% n=310	63% n=278
Incentives were #1 deciding factor[1] (of respondents who said they played a role)	45%* n=156	60%* n=134
Incentives were #1 deciding factor (of all respondents)	23%* n=310	29%* n=278

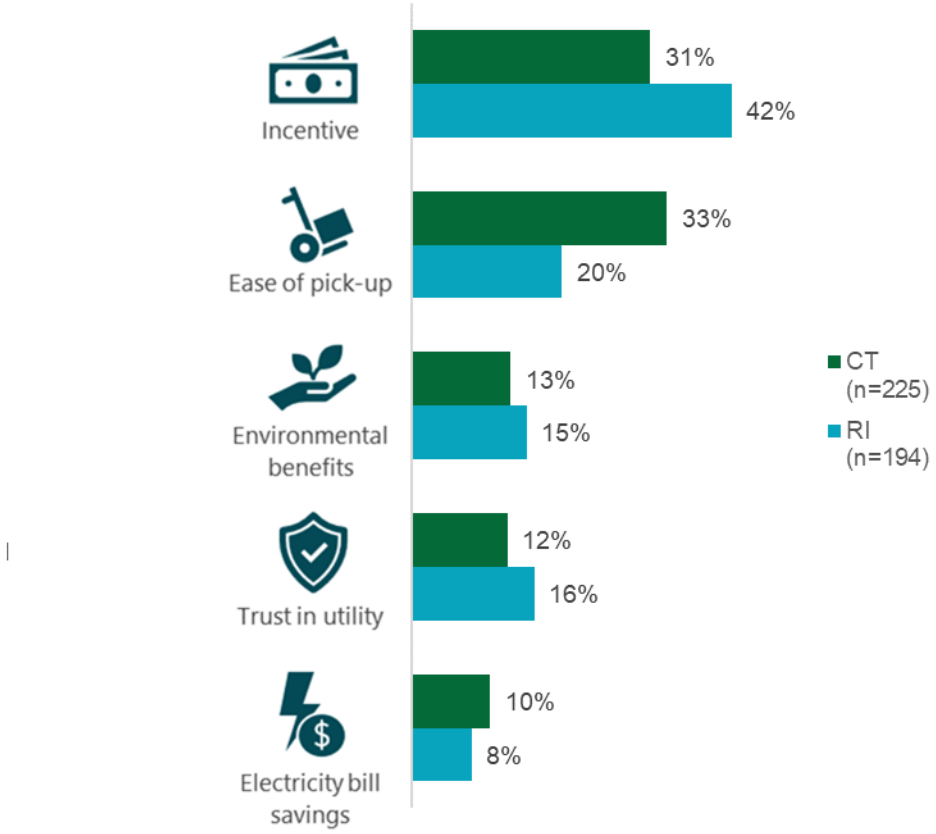
[1] Excludes missing responses from 96 respondents who indicated incentives played a role in their decision to participate.

* Difference is statistically significant at the 90% confidence level.

Connecticut respondents named the ease of pickup (33%) and then the incentive (31%) as their most important reasons for participating (Figure 5). In contrast, Rhode Island respondents named the incentive as their most important reason for participating (42%) followed by the ease of pick-up (20%). The difference in the importance may reflect that Rhode Island respondents received higher incentives ($50 or $125) than Connecticut participants ($30 or $60).

Figure 5: Most Important Reason for Program Participation[1]

(Which of these was the single most important reason for your choice to recycle with the Appliance Recycling Program?)



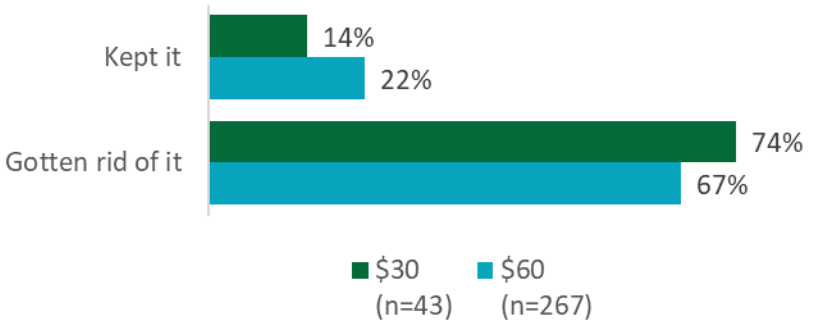
[1] Excludes missing responses for ranking of program benefits.
[2] Rhode Island's incentives for typical pickup ($50) and contactless pickup ($125) exceeded those in Connecticut ($30 and $60 respectively).

ACTIONS IN THE ABSENCE OF THE PROGRAM

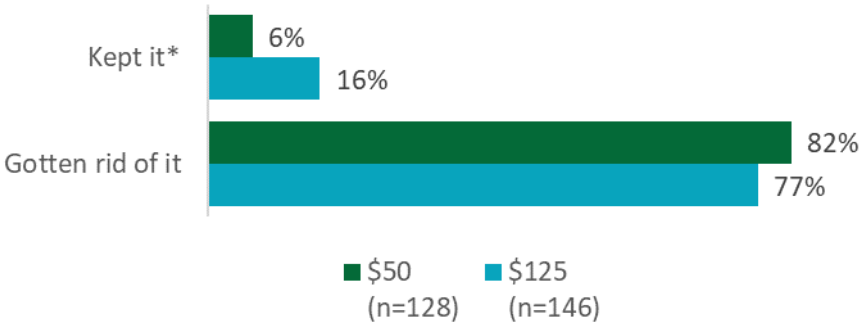
In both Connecticut and Rhode Island, households that received a larger incentive were more likely than those who received the smaller incentive to say that they would have kept the unit if the program was not available (Figure 6). This result is not likely due to behavioral changes (e.g., additional food storage needs) related to the health crisis. All Connecticut respondents took part after June 2020, but lower incentive respondents from Rhode Island took part both before and after the start of the health crisis.

Figure 6: Actions in the Absence of the Program by Incentive and State[1]

Connecticut



Rhode Island



[1] "Don't Know" responses not shown.

* Difference is statistically significant at the 90% confidence level.

Statistically greater percentages of Connecticut (23%) and Rhode Island (32%) than Massachusetts (10%) respondents who were going to get rid of the unit said that they would have recycled the appliance if they had not taken part in the program (Figure 7).[5,6] Likewise, a

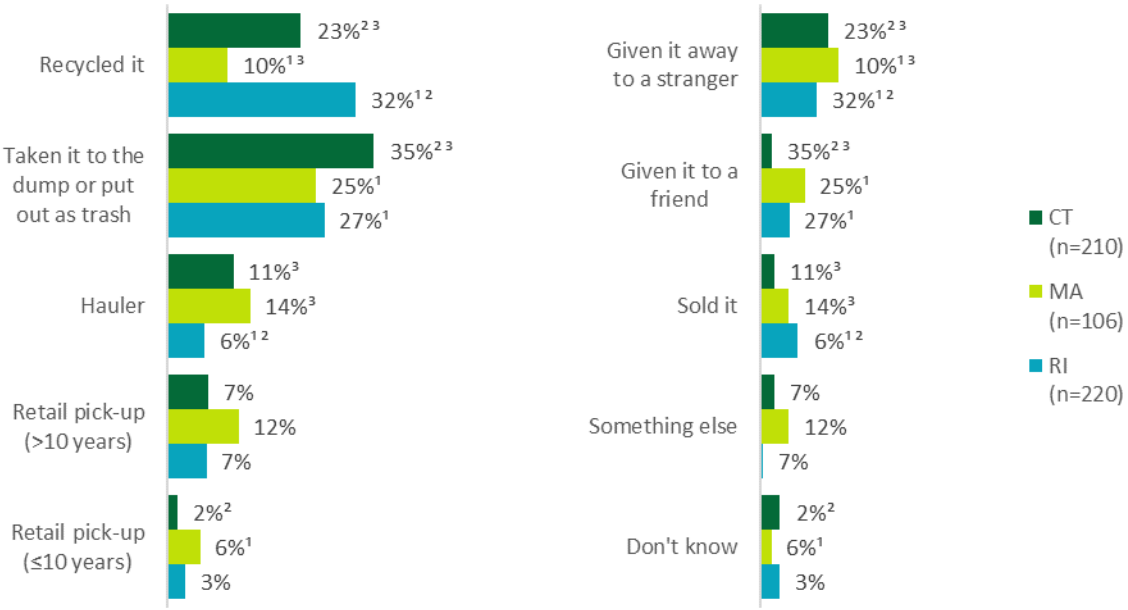
[5] NMR. 2021. MA20X03-E-ARNTG *Appliance Recycling Net-to-Gross* https://ma-eeac.org/wp-content/uploads/MA-20X03-E-Appliance-Recycling-NTGReport_FINAL_2021.07.23-clean.pdf.

[6] The Massachusetts percentage of households reporting they would recycle was stable between an earlier survey of 2017 participants and the more recent survey of 2019. NMR Group. 2018. *RLPNC 18-1 Appliance Recycling Report* Available at https://ma-eeac.org/wp-content/uploads/RLPNC_181_ApplianceRecycleReport_26SEP2018_FINAL.pdf.

statistically greater percentage of Connecticut respondents (35%) would have put the unit out with the trash or taken it to the dump compared to Massachusetts (25%) and Rhode Island (27%). The survey asked respondents who said they would have gotten rid of the unit in the absence of the program to specify how they would have done so. The study scope did not include follow-up questions or additional research to understand why some responses differed across the three states. However, the results do have implications for the NTG ratio in Connecticut, as discussed in the next section.[7]

Figure 7: Ways to Get Rid of Unit in the Absence of the Program by State

(Base = Respondents who would have gotten rid of the appliance in the absence of the program)



[1] Difference is statistically significant from Connecticut values at the 90% confidence level.
[2] Difference is statistically significant from Massachusetts values at the 90% confidence level.
[3] Difference is statistically significant from Rhode Island values at the 90% confidence level.

Net Savings and Net to Gross Ratio

In August, the EA team approved a final memo that included estimates of gross savings for the 2020 Connecticut Appliance Recycling Program. The memo also suggested a placeholder value for NTG ratios for freezers and refrigerators. The information in the memo relied on realization rates and NTG ratios from two recent Massachusetts studies.[8] This study's scope of work included a task to update Connecticut net savings and NTG ratio if the responses of Connecticut and Massachusetts program participants differed in ways that would impact the free ridership rate. The preceding section demonstrated that such differences exist. This section presents the

[7] National Grid Rhode Island's guidance for piggybacking on Massachusetts research suggests that adopting the current Massachusetts NTG ratios. Therefore, this study did not update Rhode Island's NTG ratio.
[8] NMR. 2021. *Ibid.* Guidehouse. *Ibid.*

alternative calculation of net savings and the NTG ratio for Connecticut. Appendix A.1.6 describes the approach used to estimate the NTG ratios.

The analysis yielded NTG ratios of 37% for refrigerators (Table 3) and 38% for freezers (Table 4). In comparison, the recent Massachusetts study found NTG ratios of 46% for refrigerators and 50% for freezers. The differences between states were largely driven by the greater tendency for Connecticut respondents to say that they would have recycled the unit, taken it the dump, or left it out for their trash pickup (Figure 8).

Table 3: Refrigerator Net Savings Calculations[1]

(Base = Refrigerator Respondents; n = 243)

Net Savings Assignment	Col A Per Unit Net Savings (kWh)	Col B % of Refrigerators	Col A x Col B Weighted Savings (kWh)
Free Riders	0	54%	0
Transfer Free Riders	0	6%	0
Non-free Riders	839	23%	197
Transfer Non-free Riders	839	11%	93
Transfer Other (Partial Free Riders)	394	6%	22
Net Savings			312
Adjusted Gross Savings			839
NTG (Net/Gross)			**37% (32%, 42%)**

[1] Results subject to rounding error.

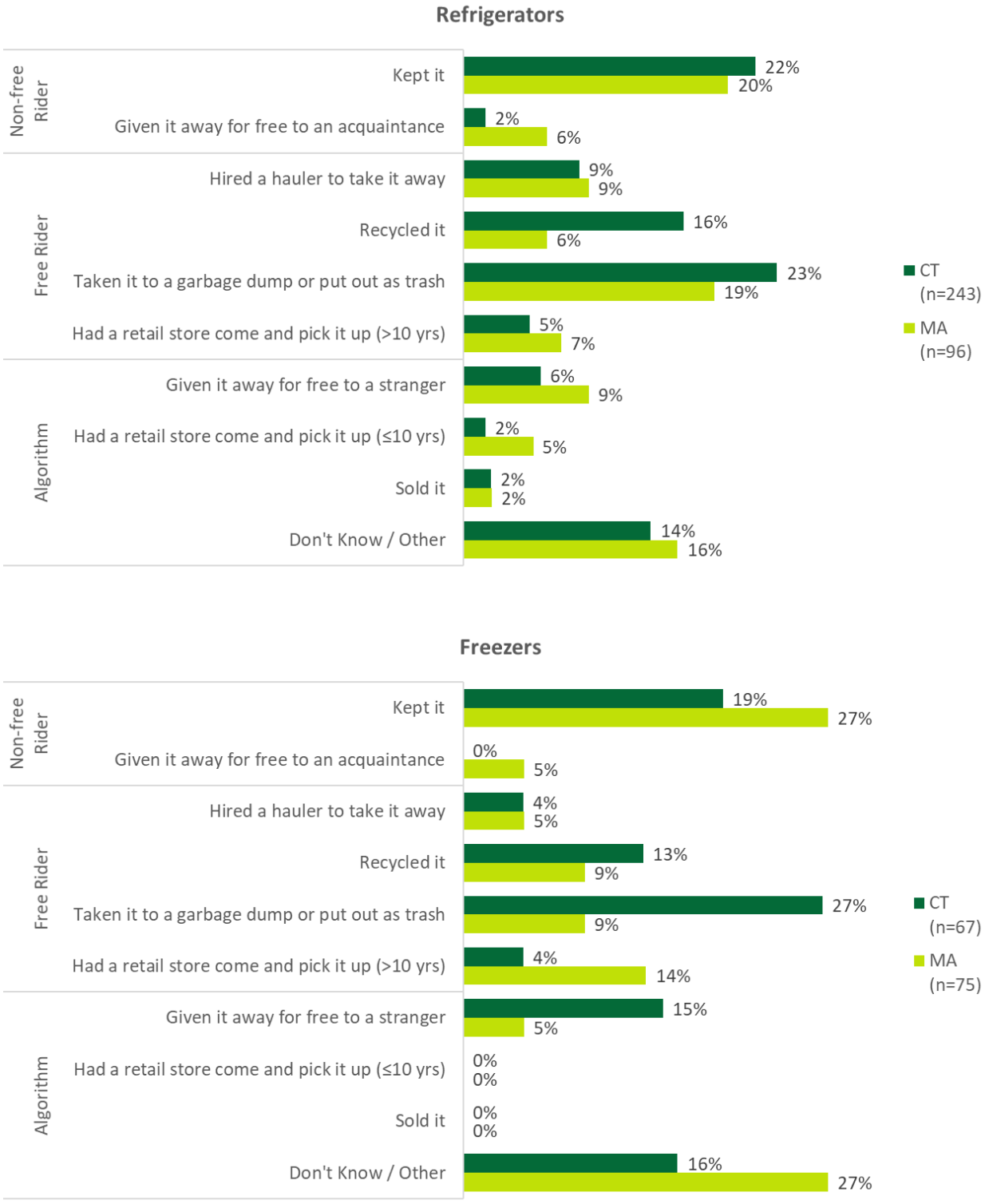
Table 4: Freezer Net Savings Calculations[1]

(Base = Freezer Respondents; n = 67)

Net Savings Assignment	Col A Per Unit Net Savings (kWh)	Col B % of Freezers	Col A x Col B Weighted Savings (kWh)
Free Riders	0	49%	0
Transfer Free Riders	0	8%	0
Non-free Riders	631	19%	122
Transfer Non-free Riders	631	16%	99
Transfer Other (Partial Free Riders)	272	8%	21
Net Savings			243
Adjusted Gross Savings			631
NTG (Net/Gross)			**38% (29%, 47%)**

[1] Results subject to rounding error.

Figure 8: Likely Actions in the Absence of the Program by Appliance and State



Attribution of Reclaimed Materials

This study assessed how alternative dispositions would have affected the safe reclamation and disposal of chlorofluorocarbons (CFCs), other refrigerants, and hazardous materials as well as recyclable materials such as metals, plastics, and glass. The analysis suggests that 60% of the recycled materials would have been reclaimed outside of the program. This means that the program should be attributed 40% of the materials recycled. The study applied the following scheme (Table 5) to designate which units would and would not have been recycled in an environmentally safe manner.[9] This value was applied to the gross reclaimed materials amounts calculated by ARCA. Table 6 shows the original calculations and the recommended adjustments.

Table 5: Attribution Assignment[1]

Self-reported Disposition in the Absence of the Program	Decision	Percent of Respondents
Kept by the household	Would not be recycled	25%
Given away for free to an acquaintance	Would not be recycled	1%
Sold/given to charity, classified ads, internet, etc.	Would not be recycled	11%
Provided to retailer (new or used)	If older than ten years, would be recycled	6%
	If ten years or younger, would not be recycled	1%
Surrendered to municipality / hired a hauler	Would be recycled	26%
Taken it to a garbage dump / put it out as trash	Would be recycled	29%

[1] Results subject to rounding error.

[9] The category of "Taken it to a garbage dump / put it out as trash" was added to the Connecticut survey and has been included in the table because a substantial number of respondents selected this option. Note that the scheme assumes the proper reclamation of materials from these units. This is almost certainly true for anything valuable (such as metals) but may not be true for hazardous waste or non-valuable recyclables.

Table 6: Program Attributed Amounts of Reclaimed Materials

Environmental Benefit	Reclaimed Material	Original Claim[1]	Recommended Claim
Ozone Protection	O-zone Depletion Potential (weighted kg)	88	35
Landfill Diversion	Ferrous metals (pounds)	75,680	30,272
	Non-ferrous metal (pounds)	3,700	1,480
	Glass (pounds)	1,815	726
	Plastic (pounds)	217	87
Proper Handling of Hazardous Waste Materials	PCB-containing capacitors	0.605	0.242
	Gallons of used oil	44	18
	Mercury-containing components	13	5

Recommendations and Guidance

The study yields the following recommendations.

- **Recommendation 1: The study recommends that the utilities adopt the PSD updates listed in Table 7.**

The gross savings estimates reflect the outcome of applying the characteristics of units recycled in Connecticut in 2020 to regression equations recommended by the UMP. The gross savings estimates also incorporate information from Massachusetts on the percentage of units used in spaces that are conditioned in the summer and winter. The realization rates come directly from recently completed research in Massachusetts and capture the percentage of the year prior to recycling that the unit was in use. The NTG ratio reflects what Connecticut respondents believe would have happened to the unit had the participant not recycled it through the program. Should the program change incentives, the gross savings and realization rates would remain the same, but the NTG ratio may change, as discussed in Recommendation 3.

Table 7: 2020 and Recommended PSD Values

Savings Input	Refrigerator		Freezer	
	Current	Recommended	Current	Recommended
Gross Savings (kWh)	794	932	846	760
Realization Rate	1.00	0.90	1.00	0.83
NTG Ratio[1]	**0.69**	**0.37**	**0.59**	**0.38**

[1] **The PSD lists the free-ridership rate, which is 1 - NTG.**

- **Recommendation 2: The program should keep the incentive at $30 but also offer special offers at higher incentive levels.**

The study did not provide clear signals about where the utilities should set the optimal incentive level. On the one hand, the higher contactless incentives convinced some households to get rid of an appliance they would have otherwise kept. Likewise, over 60% of respondents cited the

incentive as one of the program drivers. On the other hand, many households appear willing to participate at lower incentives levels – or even with no incentive at all - especially if the program picks the units up from inside the home. Importantly, Connecticut respondents show the same tendencies, even though their contactless and typical incentive amounts were less than Rhode Island's. Given the conflicting information, it would be prudent to retain the current incentive and examine the possibility of holding limited time promotions at higher incentives (as Rhode Island has done in the past). This approach may strike the right balance between inducing greater participation by offering a higher incentive, while limiting free-ridership of the people who would have recycled their unit anyway, either outside of the program or for no incentive. To induce participation, the program should stress the limited time nature of the promotion and explicitly compare it to the more typical incentive.

- **Recommendation 3: Should the program decide to permanently raise incentives, the NTG ratio should be raised to match those in Massachusetts and Rhode Island: 46% for refrigerators and 50% for freezers.**

A greater proportion of Connecticut and Rhode Island respondents who received higher incentives said they would have kept the unit without the program. This implies that the incentive induced at least some respondents to get rid of units they may have otherwise held onto. Raising the incentive should lower free-ridership and increase NTG. Therefore, the study recommends adopting regional NTG ratios if the program raises incentives.

- **Recommendation 4: Although the program does not currently account for non-energy impacts, the study suggests that 40% of the materials reclaimed or recycled can be directly attributed to program efforts.**

Appliance recycling programs not only reduce electricity use, but they also ensure the safe reclamation of refrigerants and hazardous materials and divert materials from landfills. However, as with net savings, some of the appliances recycled through the program may have ultimately been recycled in similarly responsible manners. Taking these alternative outcomes into account suggests that the program should be attributed 40% of reclaimed / recycled material amounts. Based on stated alternative outcomes for appliances in Massachusetts, the attribution of recycled materials should remain 40% in Connecticut if the utilities increase the incentive.

- **Consideration 1: The utilities and the implementation contractor should consider whether it makes programmatic sense to stop paying incentives generally but to hold special incentive-based promotions.**

Of the subset of respondents who were asked, 52% of Connecticut respondents and 46% of Rhode Island said that they would have participated with no incentive. Likewise, the statistical model predicted relatively high participation rates even with substantial incentive reductions. The study refrains from recommending that the program remove incentive for two reasons. First, all respondents have participated in the program, which, due to anchoring and nudging, may bias responses about their WTA a lower incentive compared to the general eligible population. Second, many respondents had to move the unit outside the home during the contactless protocols period, so their WTA a lower incentive in the scenario described in the survey could reflect the greater ease of having a unit picked up from inside the home. In short, the survey and

modeling results contain too much uncertainty to conclude that the program could maintain current levels of participation by dropping the incentive but continuing to pick units up from inside homes. Yet, the possibility exists that this program design could be effective. Therefore, the utilities and ARCA should consider whether such a design would be feasible, pragmatic, and cost effective.

- **Guidance 1: Future survey research into optimal incentive levels may consider providing the following (or similar) response options when asking respondents if they would participate given a specific incentive amount.**

  Would you participate if the incentive was XX?

  a. Yes
  b. Probably yes
  c. Probably no
  d. No

About 33% of respondents to the Connecticut and Rhode Island appliance recycling surveys answered "Maybe" or "Don't Know" when asked if they would have still recycled their appliance through the program at a lower incentive level. These non-committal responses complicated efforts to predict the optimal incentive level. The analysis used other survey responses to assign the "Maybe" and "Don't Know" responses to either "Yes, would have participated" or "No." The suggested responses listed above would allow future analysts to assign non-committal respondents to "Yes" or "No" in the predictive model based on the respondent's inclination toward or against participation at the specified incentive level.

- **Guidance 2: Non-participant surveys could provide a stronger indication than participant surveys of where to set the optimal incentive level.**

The survey respondents have already taken part in the program at existing incentive amounts. The results also indicate that they anchor the reduction in incentive that they are willing to accept to the original incentive they received. A design that seeks to understand what amount would entice non-participants to recycle their secondary refrigerators or freezers or their former primary refrigerators with the program should provide a stronger signal about the optimal incentive level. The program recycles primary refrigerators, so the population incidence of eligible customers is high. Therefore, a few questions could be added to existing general population surveys, such as future residential baseline and appliance saturation studies or customer satisfaction surveys.

Appendix A Detailed Methodology

The research presented in this memo relied on participant surveys in Connecticut and Rhode Island. The study conducted statistical analysis on the survey results, including comparing results across Connecticut and neighboring Massachusetts and Rhode Island and performing statistical modeling meant to predict the amount of incentive reduction participants would have accepted and still taken part in the program.

A.1 Participant Survey

The study relied on information collected through web surveys with 2020 participants in the Connecticut Appliance Recycling Program and 2019 and 2020 participants in the Rhode Island Appliance Recycling Program. The surveys sought information on the following:

- Alternative outcomes for appliances if they had not been recycled through the programs
- Participant sensitivity to incentive levels
- Importance of incentives relative to other benefits for inducing program participation

Participant responses to the survey questions allowed investigation of the influences of incentive amounts, pick-up mode (in-home or contactless), and environmental benefits on participation. The responses were also applied in a statistical model that explored the optimal incentive level for inducing participation.

A.1.1 Sample Design

The sample design presented in Table 8 reflects the desire to gather information from enough participants in each state and for each appliance to provide results with an acceptable level of statistical precision (sampling error). The study targeted a total of 440 completes: 220 in each state, further divided into refrigerator and freezer sampling strata. The design aimed for sampling errors of 10% absolute precision and 20% relative precision at the 90% confidence level in each of the four strata. In actuality, the study exceeded the desired sample size, achieving 588 completes across the two states: 310 in Connecticut and 278 in Rhode Island. The survey met the desired precision levels for all strata except Rhode Island freezers.

Table 8: Sample Design

	Population	Desired Sample	Achieved Sample	Achieved Sampling Error	
				Absolute Precision	Relative Precision
CT Freezers	135	50	67	7%	14%
CT Refrigerators	605	170	243	4%	8%
CT Overall	**740[2]**	**220**	**310**	**4%**	**7%**
RI Freezers	630	90	36	14%	27%
RI Refrigerators	6,590	130	242	5%	10%
RI Overall	**7,220[2]**	**220**	**278**	**5%**	**10%**
Total	**7,960**	**440**	**588**	**4%**	**9%**

[1] 90% confidence level using a conservative assumed result of 50%. Results subject to rounding error.

[2] Some participants recycled both a freezer and a refrigerator. The total number of unique participants was 702 in Connecticut and 6,528 in Rhode Island.

A.1.2 Sample Recruitment

The study used postcards to invite participants to take part in the survey (Appendix C). Postcards were mailed to all 702 Connecticut participants and offered them $15 to complete the survey. They sent postcards to 1,101 randomly selected Rhode Island participants and offered them $10 to respond to the survey. The higher incentive in Connecticut reflected concerns about meeting the desired sample size with a small population.

The postcards went out on July 16, 2021, and asked recipients to complete the survey by July 30. A reminder email was sent on July 27 to 1,168 potential respondents who had not yet completed the survey and for whom email addresses were included in the data. By July 30, the number of completions had exceeded the desired sample size for both appliances in Connecticut and for refrigerators in Rhode Island. At that point, the survey was closed for all potential respondents except Rhode Island freezer participants. Additional outreach was conducted to Rhode Island freezer participants. They closed the survey for all potential respondents on August 14. The final Rhode Island freezer sample fell short of the desired number of completions, but it was unlikely that additional outreach would lead to the desired number of completions without causing delays or burdening the study budget.

These recruitment efforts yielded 588 completes and a response rate of 31% (Table 9). The response rates were higher in Connecticut than in Rhode Island. Two factors likely explain the difference in response rates: (1) the higher incentive in Connecticut ($15 vs. $10) and (2) the longer elapsed time between program participation and survey launch in Rhode Island. All participants in Connecticut recycled their appliance within 12 months of being surveyed, whereas in Rhode Island, participants recycled their appliances up to 28 months before being surveyed. In reporting the survey results, the base is all respondents unless otherwise noted.

Table 9: Response Rates

	N (A)	Emails		Postcards		Overall		
		Sent	Bounced	Mailed	Returned	Failed to Reach (B)	Com-pletes (C)	Response Rate (C ÷ (A – B))
CT Freezers	134	78	1	134	2	1	67	50%
CT Refrigerators	568	405	11	568	14	0	243	43%
CT Overall	**702**	**483**	**12**	**702**	**16**	**1**	**310**	**44%**
RI Freezers	192	124	6	123	7	7	36	19%
RI Refrigerators	1,006	626	30	1006	51	16	242	24%
RI Overall	**1,198**	**1,003**	**36**	**1,129**	**58**	**23**	**278**	**24%**
Total	**1,900**	**1,486**	**48**	**1,831**	**74**	**24**	**588**	**31%**

A.1.3 Statistical Analysis Approaches

The study used two types of statistical analysis: comparative analysis and statistical modeling.

A.1.4 Comparative Analysis

The analysis applied Student T tests and Chi-squared tests to compare differences in survey results between Connecticut, Massachusetts, and Rhode Island. The comparisons test to understand the following:

- Whether alternative outcomes for appliances varied by state, incentive levels, or pick-up approach
- The importance of the incentive relative to other program benefits

A.1.5 Statistical Modeling

To determine sensitivity to incentive and optimal incentive level, the study assessed participants' willingness to accept (WTA) a lower incentive using the contingent valuation method. Survey respondents were assigned an alternative incentive value (Figure 9). Regardless of whether the program picked the unit up inside or outside of the home, the survey asked respondents whether they would participate in the program if the program removed the unit from inside their home at the lower incentive level. The survey asked about in-home pickup because it is the usual way the implementer collects recycled appliances.

The Appliance Recycling Program temporarily adopted a contactless pickup protocol in 2020. Usually, the program staff removes appliance from inside customers' homes. For the next question, please answer assuming the program would remove the appliance from inside of your home.

Would you still have recycled the appliance through the Appliance Recycling Program if the rebate was $X?

1. *Yes*
2. *No*
3. *Maybe*

98. Don't know

Figure 9: Incentive and Alternative Incentive Levels by State

	Connecticut		Rhode Island		
	$30	$60	$50	$75	$125
Number of Respondents	43	267	128	4	146
Alternative Incentive Amounts					
$0	49%	54%	48%	50%	23%
$15	51%	0%	0%	0%	0%
$30	0%	46%	52%	25%	27%
$60	0%	0%	0%	25%	27%
$100	0%	0%	0%	0%	23%

Because the respondents had already participated in the program, the survey restricted the alternative incentive (an approach referred to as bounded WTA). While the study randomly assigned the alternative incentive amounts, they anchored them to the incentive that participants received. Given these constraints, the statistical model predicted the likelihood to participate in the program based on the reduction in incentive amount rather than on the alternative incentive amount. The study takes the difference in the original incentive and the alternative incentive to obtain a reduction in incentive amount used in the statistical modeling described below.

The analysis uses a probit model to predict the likelihood of program participation based on survey respondents' WTA a reduction in the incentive. This model specification includes a bid variable that is the reduction in incentive. The bid variable is the primary predictor. The model controls for whether the survey respondent self-reported having to move the unit outside during the contactless pickup period, the type of appliance they recycled, and demographic variables such

as whether they have a college or Bachelor's degree, whether they are over 60 years of age, whether they are a homeowner, and their state of residence. The resulting model is as follows:

$$Pr(Participate_i = 1 \mid \boldsymbol{X}) = \varphi(\alpha + \beta_1 IncentiveReduction_i + \beta_2 OutsidePickup_i + \beta 3 Refrigerator_i + \beta 4 CollegeDegree_i + \beta_5 Over60Years_i + \beta_6 Homeowner_i + \beta_7 Connecticut_i)$$

where,

- *$Participate_i$ is a binary variable denoted as one or zero, where "1" is the respondent would participate in the program for a (randomly assigned) lower incentive than the one they originally received through the program and "0" is the respondent would not participate*
- *α is the intercept*
- *$IncentiveReduction_i$ is a continuous variable representing the reduction in program incentive*
- *$\beta 1$ is the slope coefficient representing the impact of the variable it precedes on participation*
- *$OutsidePickup_i$ is the binary variable indicating whether the respondent reported having to move their unit outside during the contactless pickup period*
- *$Refrigerator_i$ is the binary variable indicating whether the participant had recycled a refrigerator (compared to a freezer)*[10]
- *$CollegeDegree_i$ is the binary variable indicating whether the participant had at least an Associate's or Bachelor's degree*
- *$Over60Years_i$ is the binary variable indicating whether the participant was over 60 years of age*
- *$Homeowner_i$ is the binary variable indicating whether the participant was a homeowner*
- *$Connecticut_i$ is the binary variable indicating whether the participant was a Connecticut resident (compared to Rhode Island)*

For all binary variables, the named characteristic is scored as "1" and all others as "0". For example, participants over 60 years of age were scored as one, while younger participants were scored as zero.

As Table 10 shows, about one-half of respondents in both states said they would still have participated at the lower incentive, regardless of which alternate incentive they were assigned. Importantly, one-third of respondents (33%) in each state selected "Maybe" or "Don't Know" when asked if they would still have recycled the appliance at the lower incentive amount. Because the

[10] The study ran a single model because the program does not vary incentives by appliance. Combining the appliances also increases statistical power and limits the bias associated with small freezer sample sizzes.

probit model requires a binary response ("Yes" or "No") to the participation question, the study assigned the "Maybe" and "Don't Know" responses to "No" if the respondent indicated that the incentive played a role in their decision to participate in the program and "Yes" if the incentive did not, when predicting the optimal incentive level. A sensitivity analysis was also conducted by recategorizing the "Maybe" and "Don't Know" responses as "Yes" and then as "No" in two additional probit models.

Table 10: Program Participation at a Reduced Incentive by State

(Would you still have recycled the appliance through the Appliance Recycling Program if the rebate was $X?)

	Connecticut	Rhode Island
Number of Respondents	310	278
Yes	49%	50%
No	19%	17%
Maybe	27%	28%
Don't know	5%	5%

A.1.6 Net-to-Gross Ratio Estimation

To develop the net savings estimates, survey results were applied to an algorithm developed for the Uniform Methods Project.[11] This algorithm specifies a portion of program-attributed gross savings to each unit based on what respondents believe they would have done with the appliance had they not recycled it with the program. There are three general scenarios for what could have happened to an appliance:

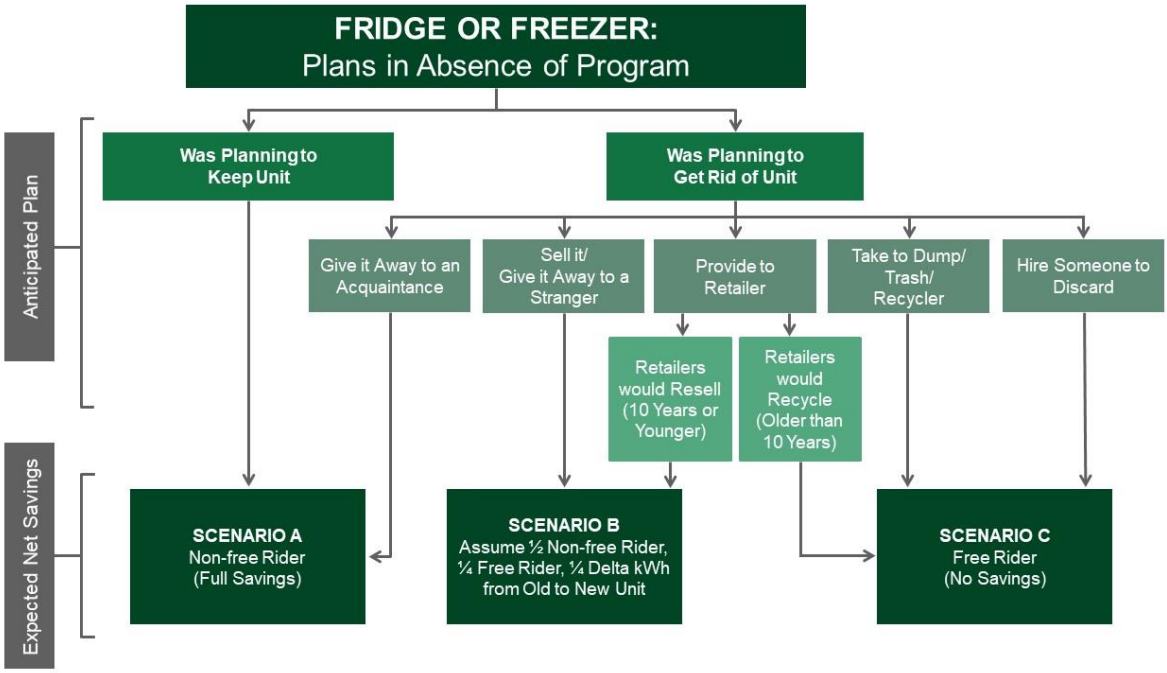
1. The household would have kept the unit or given it directly to a close acquaintance.
2. The unit would have been transferred directly or indirectly to another customer (other than a close acquaintance) for continued use.
3. The unit would have been discarded by a method that would lead to its permanent removal from service.

The first scenario does not constitute free ridership, while the third scenario does constitute free-ridership. The second scenario is ambiguous because the ultimate outcome for the unit becomes unclear upon transfer to another person. For this reason, the study used the Free Ridership Algorithm (**Error! Reference source not found.**) to assign the following:

- Full adjusted gross savings[12] to one-half of the transferred units; this assumes that the units would have remained in use (non-free riders).
- Units surrendered to retailers that are older than ten years of age would have been permanently removed from service (free riders)
- Zero savings to one-quarter of the remaining transferred units; this assumes that units would have been removed from use (free riders).
- For the remaining quarter of units, the difference in usage from a typical unit recycled through the program to a comparable new unit (Delta kWh); this assumes that would-be purchasers of a used appliance must buy a new unit because the program diverts the used one from the used appliance market.

[11] Keeling, J.; Bruchs, D. 2017. "Chapter 7: Refrigerator Recycling Evaluation Protocol." *The Uniform Methods Project: Methods for Determining Energy-Efficiency Savings for Specific Measures*. Golden, CO; National Renewable Energy Laboratory. NREL/SR-7A40-68563. http://www.nrel.gov/docs/fy17osti/68563.pdf.
[12] That is, after applying the realization rate.

Figure 10: Free Ridership Algorithm[1]



[1] The study scope called for a sensitivity analysis in which units that were given away to an acquaintance were alternately treated as non-free riders or subject to the transferred use algorithm. However, only 2% of Connecticut respondents indicated this outcome, which would have had little impact on the NTG ratio.

Appendix B Detailed Analysis Results

The appendix presents additional analysis and results from the incentives exploration and the characteristics of survey respondents.

B.1 Statistical Analysis

The survey asked respondents whether they would participate in the program for a lower incentive. Responses of "Maybe" and "Don't Know" were recoded to "No" if the respondent also said the incentive was an important factor in their decision to participate in the program. Table 11 shows the probit regression model results based on this recoding. The combined model in the second column of Table 11 is the preferred model discussed in the body of the report. The sample means of the explanatory variables used in the computation for the combined model WTA are Outside Pickup (mean = 0.3457), Refrigerator (mean = 0.1738), College Degree (mean = 0.7893), Over 60 years (mean = 0.464), Homeowner (mean = 0.9649), and Connecticut (mean = 0.5194).

Table 11: Main Probit Model Results

(Maybe/Don't Know = "No" if incentive was a deciding factor in program participation)

Input	Combined (Preferred Model)	Combined (excl. $125 incentive)	Connecticut Only	Rhode Island Only
Intercept	1.497	1.491	1.122	1.362
Bid (Incentive reduction)	-0.014	-0.015	-0.011	-0.018
Outside Pickup (percent)	0.249	0.034	0.039	0.639
Refrigerator (percent)	0.112	0.036	0.068	0.158
College Degree (percent)	-0.087	-0.05	-0.198	0.084
Over 60 years (percent)	0.394	0.486	0.556	0.202
Homeowner (percent)	-0.555	-0.691	-0.599	-0.389
Connecticut (percent)	-0.358	-0.182	1.122	1.362
Number of respondents	541	404	281	260
Pseudo R2	0.0759	0.0668	0.0580	0.1197

Table 12 shows the average WTA an incentive reduction for Connecticut and Rhode Island based on the results shown in Table 11. The preferred model takes advantage of the larger sample size and greater variability in the bid (incentive reduction) variable compared to individual state models.

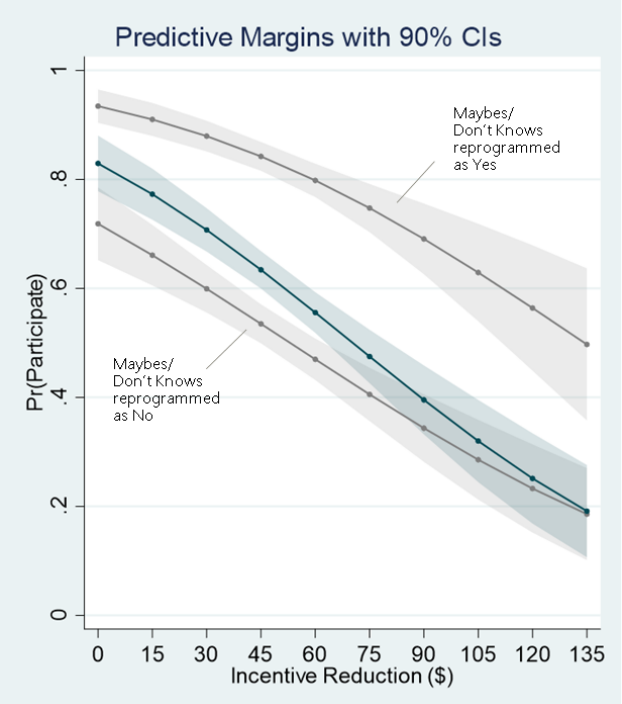
Table 12: WTA Incentive Reduction[1]

	Combined (Preferred Model)	Combined (excl. $125 incentive)	Connecticut only	Rhode Island only
Number of Respondents	541	404	281	260
Connecticut	$58 ($49, $70)	$57 ($48, $74)	$63 ($49, $112)	--
Rhode Island	$84 ($73, $98)	$70 ($54, $102)	--	$78 ($69, $89)
Average	$70 ($63, $80)	$63 ($53, $85)	--	--

[1] Confidence intervals in parentheses.

Figure 11 shows how the reduction in the incentive impacts the probability of participation for the preferred model. As part of the sensitivity analysis, the figure shows that the preferred model results (middle curve) fall between the model variations where the "Maybe" and "Don't Know" responses were reprogrammed as "Yes" (top curve) and where the "Maybe" and "Don't Know" responses were reprogrammed as "No" (bottom curve).

Figure 11: Probability of Program Participation by Reduction in Incentive Combined Model[1]



[1] Shaded region depicts the confidence intervals.

B.2 IMPORTANCE OF INCENTIVES

Connecticut refrigerator and freezer respondents showed no statistically significant differences in their tendency to name incentives as the most important factor in participating (**Error! Reference source not found.**). About 60% of all Connecticut respondents included incentives among the reasons they participated, and about one-quarter named incentives as the most important reason. In Rhode Island, a greater proportion of refrigerator respondents (63% of those who said incentives played a role, 31% of all respondents) than freezer respondents (36% of those who said incentives played a role, 14% of all respondents) named the incentive as the most important factor in participating.

Figure 12: Importance of Incentive in Decision to Participate in the Program by State and Appliance Type

	Connecticut		Rhode Island	
				
Incentives played a role (of all respondents)	60% n=243	61% n=67	63% n=242	61% n=36
Incentives were #1 deciding factor[1] (of respondents who said they played a role)	43%[2] n=125	52% n=31	63%[3*] n=120	36%[*] n=14
Incentives were #1 deciding factor (of all respondents)	22%[2] n=243	24% n=67	31%[3*] n=242	14%[*] n=36

[1] Excludes missing responses from 96 respondents who indicated incentives played a role in their decision to participate.
* Difference is statistically significant by appliance type at the 90% confidence level.
[2] Difference is statistically significant from Rhode Island values at the 90% confidence level.
[3] Difference is statistically significant from Connecticut values at the 90% confidence level.

The results failed to show any statistical differences in the importance of incentives by pickup approach within either state (**Error! Reference source not found.**).

Figure 13: Importance of Incentive in Decision to Participate in the Program by State and Pickup Location[1]

	Connecticut		Rhode Island	
	Inside	Outside	Inside	Outside
Incentives played a role (of all respondents)	59% n=211	63% n=97	59% n=169	69% n=109
Incentives were #1 deciding factor[2] (of respondents who said they played a role)	44%[3] n=103	45%[3] n=51	56%[4] n=78	66%[4] n=56
Incentives were #1 deciding factor (of all respondents)	21% n=211	24% n=97	26% n=169	34% n=109

[1] Excludes "Don't Know" responses to whether the unit was picked up from the inside or outside.
[2] Excludes missing responses from 96 respondents who indicated incentives played a role in their decision to participate.
[3] Difference is statistically significant from Rhode Island values at the 90% confidence level.
[4] Difference is statistically significant from Connecticut values at the 90% confidence level.

In Connecticut, more respondents who received the $60 incentive than the $30 incentive indicated that it was the most important reason for participating (**Error! Reference source not found.**). In contrast, the incentive level did not have a statistically significant impact on the importance Rhode Island respondents placed on the incentive.

Figure 14: Importance of Incentive in Decision to Participate in the Program by State and Incentive Level[1]

	Connecticut		Rhode Island	
	$30	$60	$50	$125
Incentives played a role (of all respondents)	53% n=43	62% n=267	57% n=128	67% n=146
Incentives were #1 deciding factor[2] (of respondents who said they played a role)	24%* n=21	48%* n=135	64% n=59	59% n=73
Incentives were #1 deciding factor (of all respondents)	12%* n=43	24%* n=267	30% n=128	29% n=146

[1] Excludes respondents who received $75 incentive due to small sample size.
[2] Excludes missing responses from 96 respondents who indicated incentives played a role in their decision to participate.
* Difference is statistically significant by incentive at the 90% confidence level.

B.3 Economic and Demographic Characteristics

The surveys asked respondents about the type of home they live in, whether they own or rent their home, their age, their level of education, the size of their household, and their income level. Table 13 through Table 18 show the responses to the economic/demographic questions. The results indicate that more respondents in Connecticut live in single-family housing compared to Rhode Island respondents (Table 13). While results in Table 14 show that more Rhode Island respondents owned their homes compared to Connecticut, at least 95% of respondents are homeowners across all three states. Table 15 suggests respondents tend to be older (50 years and up) across all three states. Other demographic variables, such as household size, education, and low-income status, did not reveal any notable statistically significant differences by state.

Table 13: Type of House

(What type of home do you live in? Please select one.)

	Connecticut	Massachusetts	Rhode Island
Number of respondents	305	167	276
Single family	92%[R]	89%	87%[C]
Duplex	2% [R]	4%	4%[C]
Triple decker (e.g., three-story house with each floor being a separate unit)	0% [R]	1%	2%[C]
Apartment/condo in a 2-4 unit building	1% [R]	3%	4%[C]
Apartment/condo in a 5+ unit building	2%	1%	2%
Townhouse or row house (adjacent walls to another house)	3%	1%	1%
Mobile home or trailer	0%	1%	0%

[C] Results are statistically different from Connecticut at the 90% confidence level.
[R] Results are statistically different from Rhode Island at the 90% confidence level.

Table 14: Whether the Respondent Owns or Rents

(Do you own or rent this residence?)

	Connecticut	Massachusetts	Rhode Island
Number of respondents	308	169	277
Own	95%[R]	97%	98%[C]
Rent	5%[R]	3%	2%[C]

[C] Results are statistically different from Connecticut at the 90% confidence level.
[R] Results are statistically different from Rhode Island at the 90% confidence level.

Table 15: Respondent Age

(Which of the following best describes your age?)

	Connecticut	Massachusetts	Rhode Island
Number of respondents	286	159	266
18-24	0%	0%	0%
25-29	2%	1%	1%
30-39	14%	11%	12%
40-49	19%[M]	11%[C]	16%
50-59	21%[R]	23%	23%[C]
60-69	29%	31%	30%
70-79	13%	18%[C,R]	15%
80-89	3%	4%	2%
90 years or older	0%	0%	1%

[C] Results are statistically different from Connecticut at the 90% confidence level.
[R] Results are statistically different from Rhode Island at the 90% confidence level.
[M] Results are statistically different from Massachusetts at the 90% confidence level.

Table 16: Respondent Level of Education

(What is the highest level of education that you have completed so far?)

	Connecticut	Massachusetts	Rhode Island
Number of respondents	294	158	263
Ninth to twelfth grade	1%	1%	0%
High school graduate	6%	7%	7%
Some college, no degree	13%	13%	14%
Associates degree	5%[M,R]	11%	11%
Bachelor's degree	33%	35%	37%
Graduate or professional degree	42%[M,R]	33%	30%

[M] Results are statistically different from Massachusetts at the 90% confidence level.
[R] Results are statistically different from Rhode Island at the 90% confidence level.

Table 17: Household Size

(Counting yourself, how many individuals typically occupy this home?)

	Connecticut	Massachusetts	Rhode Island
Number of respondents	307	171	275
One	13%	15%	11%
Two	45%	43%	44%
Three	19%	20%	20%
Four	14%	16%	15%
Five	4%[M]	2%[C]	5%
Six or more	6%	4%	4%

[C] Results are statistically different from Connecticut at the 90% confidence level.
[M] Results are statistically different from Massachusetts at the 90% confidence level.

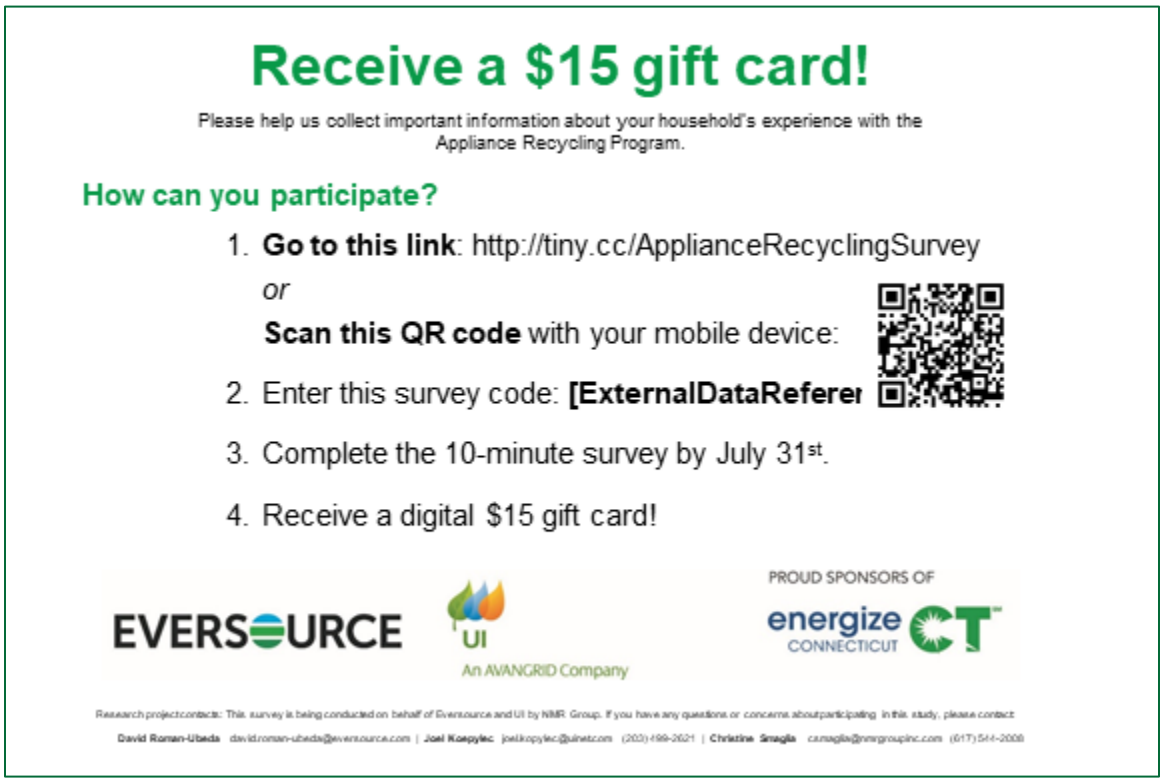
Table 18: Income

(Which of these categories best describes your total household income in 2019 before taxes – counting everyone living in your house?)

	Connecticut	Massachusetts	Rhode Island
Number of respondents	234	117	200
Above 60% of state median	85%	87%	86%
Below 60% of state median	15%	13%	15%

Appendix C Recruitment Postcards

C.1 Connecticut Postcards



C.2 RHODE ISLAND POSTCARDS

nationalgrid

For a limited time, National Grid is collecting important information from customers in Rhode Island who participated in the Appliance Recycling Program.

Receive a $10 gift card for participating!

NMR

NMR Group, Inc.
50-2 Howard St.
Somerville, MA 02144

[FirstName] [LastName]
[Street1]
[City], [State] [Zip]

Receive a $10 gift card!

Please help us collect important information about your household's experience with the Appliance Recycling Program.

How can you participate?

1. **Go to this link**: http://tiny.cc/ApplianceRecyclingSurvey
   or
   Scan this QR code with your mobile device:
2. Enter this survey code: **ExternalDataReferen**
3. Complete the 10-minute survey by July 31st.
4. Receive a digital $10 gift card!

nationalgrid

Research project contacts: This survey is being conducted on behalf of National Grid by NMR Group. If you have any questions or concerns about participating in this study, please contact:
Kimberly Crossman Kimberly.Crossman@nationalgrid.com (781) 907-1562 | **Christine Smaglia** csmaglia@nmrgroupinc.com (617) 544-2008

Appendix D Survey Instrument

CT / RI Appliance Recycling Survey Questionnaire

Survey Topics

Topic	Questions
Screening and verifying product counts and types	V Series
Program Alternatives	RF1, RF2
Optimal Incentives	RF3 TO RF8
Incentives vs Other Benefits	RF9 to RF11
Program Recommendation	P Series
Demographics	D Series

Sample Frame Variables

Variable	Explanation
STATE	Location-based variable (CT or RI)
YEAR	Program year variable (2019 or 2020)
QTY	Quantity of the appliances recycled variable
INCENTIVE	Read-in – Incentive amount received by participant
ALT_INCENTIVE	Read-in – Random lower incentive than amount received by participant
APPTYPE1	Appliance variable (Freezer or Refrigerator)
CONFIGURATION1	Read-in – Unit configuration
UNIT.BRAND1	Read-in – Unit brand
SPONSOR	Read-in – Utility/sponsor

KEY

[ ] = Instructions for programmer

D.1 INTRODUCTION

Thank you for taking the time to complete this survey for [SPONSOR].

This survey asks questions about your household's participation in the Appliance Recycling Program. We are contacting customers who recycled refrigerators and freezers in the past couple years. Please have the person who made the decision to recycle the appliance complete the survey. Answer the questions to the best of your ability. All your responses will remain confidential. The survey should take about 10 minutes to complete.

[SPONSOR] has partnered with NMR Group to administer this survey. If you have any technical questions about the survey, wish to receive the survey link via email, or would like to answer by phone, please contact Christine Smaglia at (617) 544-6230 ext. 2008 or

csmaglia@nmrgroupinc.com. If you have questions about validity of the survey, please contact [SPONSOR] at [SPONSOR CONTACT].

D.2 VERIFICATION AND RECALL

V1. Just to confirm, are you the person who made the decision to recycle the appliance(s)?

1. Yes **[GO TO V2]**
2. No **[TERMINATE]**

98. Don't know **[TERMINATE]**

V2. Our records indicate that your household recycled an appliance with **[INSERT SPONSOR]**. Someone would have come to your home and picked up your old refrigerator or freezer to recycle it**. [IF STATE = RI DISPLAY "**They may also have removed an old dehumidifier."**]** You would have received a rebate for each appliance you recycled.

Our records indicate that you recycled:

[READ IN NUM.RF] refrigerator(s)

[READ IN NUM.FZ] freezer(s)

[DISPLAY IF STATE = RI] [READ IN NUM.DH] dehumidifier(s)

Is this correct?

1. Yes **[GO TO PROGRAM INFORMATION]**
2. No, do not recall participating **[THANK AND TERMINATE]**
3. No, different quantities or appliances **[GO TO V3]**

98. Don't know **[THANK AND TERMINATE]**

V3. **[IF V2 = 3]** Thinking only about any appliances that were picked up through the Appliance Recycling program, please enter the number of **[IF STATE = RI DISPLAY "**refrigerators, freezers, and dehumidifiers."**] [IF STATE = CT DISPLAY "**refrigerators and freezers"**]** you recycled. Enter zero if you did not recycle the appliance.

1. Refrigerators **[ENTER QUANTITY, MUST BE ZERO OR GREATER]**
2. Freezers **[ENTER QUANTITY, MUST BE ZERO OR GREATER]**
3. **[DISPLAY IF STATE = RI**] Dehumidifiers **[ENTER QUANTITY, MUST BE ZERO OR GREATER]**

[IF V3.1=0 AND V3.2=0, THANK AND TERMINATE]

[IF V3.2 > 0, REASSIGN APPTYPE1 = "freezer"]
[IF V3.1 > 0 AND V3.2 = 0, REASSIGN APPTYPE1 = "refrigerator"]
[IF V3.1 AND V3.2 > 0, REASSIGN APPTYPE1 = "freezer"]

[CREATE 'QTY' IF MORE THAN ONE UNIT RECYCLED (OF ANY TYPE)]

D.3 PROGRAM INFORMATION

P1. How did you find out about this program? Select all that apply **[RANDOMIZE 1-8, MULTIPLE RESPONSE]**

1. Utility bill insert
2. Utility website
3. Online or email advertisement
4. Print advertisement
5. Radio advertisement
6. Social media (Facebook, LinkedIn, Twitter, Instagram)
7. Co-worker, family or friend
8. Appliance dealer or store employee

97. Other **[OPEN END]**
98. Don't know

D.4 REBATE SERIES

This set of questions will ask about the old **[INSERT APPTYPE1]** that you had removed by the Appliance Recycling Program.

[IF V3.1 + V3.2 > 1] We are aware that you recycled more than one appliance with the Appliance Recycling Program. For purposes of this survey, please think about the **[IF UNIT.BRAND1<>" " Unit.Brand1]] [INSERT APPTYPE1]** with a **[Configuration1]** configuration**.** Please keep only that one **[INSERT APPTYPE1]** clearly in your mind as you answer the next few questions.

[IF (V3.1 + V3.2 > 1) AND (Unit.Brand1=BLANK OR Configuration1 = BLANK)] We are aware that you recycled more than one appliance with the Appliance Recycling Program. For purposes of this survey, please think about the **[INSERT APPTYPE1] that you use most frequently.** Please keep only that one **[INSERT APPTYPE1]** clearly in your mind as you answer the next few questions.

RF1. If the Appliance Recycling Program had not been available to you, what would you most likely have done with your **[INSERT APPTYPE1]**? **[ALLOW ONLY ONE RESPONSE]**

1. Gotten rid of it
2. Kept it [**GO TO RF3]**

98. Don't know [**GO TO RF3]**

RF2. **[ASK IF RF1 = 1]** If the Appliance Recycling Program had not been available to you, what would you most likely have done to get rid of the **[INSERT APPTYPE1]**? **[RANDOMIZE 1-8, ALLOW ONLY ONE RESPONSE]**

1. Sold it
2. Given it away for free to someone I know
3. Given it away for free to a stranger or charity
4. Recycled it through my town or city
5. Recycled it in some other way, please specify: [ALLOW OPEN-END RESPONSE]
6. Taken it to a garbage dump or put it out as trash
7. Hired a hauler to take it away
8. Had a retail store come and pick it up

97. Something else, please specify: [ALLOW OPEN-END RESPONSE]
98. Don't know

RF3. Our records indicate that you received **[INSERT INCENTIVE]** for recycling this **[INSERT APPTYPE1]**. Is this correct? **[IF QTY>1 DISPLAY** "Please think only about the incentive for this **[INSERT APPTYPE1]** Do not include the amounts for any other appliances you recycled."**]**

1. Yes **[GO TO RF5]**
2. No **[GO TO RF4]**

98. Don't know **[GO TO RF5]**

RF4. **[ASK IF RF3 = 2]** How much was the incentive you received for recycling this **[INSERT APPTYPE1]**?

[IF QTY>1 DISPLAY "Please think only about the incentive for this **[INSERT APPTYPE1]**. Do not include the amounts for any other appliances you recycled."**]**

[ENTER DOLLAR AMOUNT, MUST BE ZERO TO $125].

RF5. **[IF YEAR = 2020 AND INCENTIVE = $60 OR $125; OTHERWISE GO TO RF6]** Did the program staff enter your home to get the **[INSERT APPTYPE1]**, or did you have to get the unit outside your home for a contactless pick-up? **[ALLOW ONLY ONE RESPONSE]**

1. Program staff entered my home to get the unit
2. I had to get the unit outside of my home for contactless pick-up

98. Don't know

RF6. **[IF RF5 = 1 OR (INCENTIVE NOT $60 OR $125)]** Would you still have recycled the **[INSERT APPTYPE1]** through the Appliance Recycling Program if you had to get the unit outside your home for a contactless pick-up? **[ALLOW ONLY ONE RESPONSE]**

1. Yes
2. No
3. Maybe
98. Don't know

DISPLAY TEXT: The Appliance Recycling Program temporarily adopted a contactless pick-up protocol in 2020. Usually, the program staff removes appliance from inside customers' homes. **For the next question, please answer assuming the program would remove the appliance from inside of your home.**

RF7.

[IF RF4<=30 OR RF3=Don't know] Would you still have recycled the **[INSERT APPTYPE1]** through the Appliance Recycling Program if the rebate was **$0**? **[ALLOW ONLY ONE RESPONSE]**

[IF RF4>30] Would you still have recycled the **[INSERT APPTYPE1]** through the Appliance Recycling Program if the rebate was **$30**? **[ALLOW ONLY ONE RESPONSE]**

[IF RF3 = 1] Would you still have recycled the **[INSERT APPTYPE1]** through the Appliance Recycling Program if the rebate was **[INSERT ALT_INCENTIVE IN BOLD]**? **[ALLOW ONLY ONE RESPONSE]**

1. Yes
2. No
3. Maybe
98. Don't know

ALT_INCENTIVE IN EMBEDDED DATA

	CT		RI			
Incentive Amount Received	$30	$60	$50	$75	$125	Total
Alternative Incentive Amounts	$0 $15	$0 $30	$0 $30	$0 $30 $60	$0 $30 $60 $100	5

[PROGRAMMER: RANDOMIZE ORDER OF RF8 / RF8A]

RF8. If the Appliance Recycling Program had not been available, how much, if anything, would you have been willing to pay to have someone else remove or recycle your **[INSERT APPTYPE1]** if you had to get the unit outside your home? **[ALLOW ONLY ONE RESPONSE]**

1. $0—Would not pay any amount
2. $1-25
3. $26-50
4. $51-75
5. $76-100
6. More than $100
98. Don't know

RF8a. If the Appliance Recycling Program had not been available, how much, if anything, would you have been willing to pay to have someone else remove or recycle your **[INSERT APPTYPE1]** if they picked it up from inside your home? **[ALLOW ONLY ONE RESPONSE]**

1. $0—Would not pay any amount
2. $1-25
3. $26-50
4. $51-75
5. $76-100
6. More than $100
98. Don't know

RF9. People choose to recycle their appliances through the Appliance Recycling Program for many reasons. Which of the following reasons played a role in your decision to recycle with the Appliance Recycling Program? Select all that apply. **[ALLOW MULTIPLE RESPONSE; RANDOMIZE 1-4]**

1. Incentive
2. Ease of pick-up
3. I trust the utility to recycle it correctly and safely
4. Environmental benefits
5. Electricity bill savings
6. Other, please specify:_____ [OPEN]
98. Don't know

RF10. [SKIP IF RF9=1 NOT SELECTED] How did the importance of the incentive compare to the following reason(s) in your decision to recycle? **[MATRIX, ALLOW SINGLE RESPONSE]**

[INSERT RF9 2 TO 4]

1. Much more important
2. Somewhat more important
3. About the same importance
4. Somewhat less important

5. Much less important
98. Don't know

	1. Much more important	2. Somewhat more important	3. About the same importance	4. Somewhat less important	5. Much less important	98. Don't know
[INSERT RF9 2 TO 4]						

[IF RF9 = 1 AND (RF9 = 2, 3, OR 5), REPEAT RF10 FOR ALL RF9 2 TO 5 SELECTED]

RF11. **[IF SELECTED MORE THAN ONE FROM RF9 = 1 TO 6, SHOW SELECTED RESULTS FROM RF9, RANDOMIZED IF POSSIBLE]** Which of these **was the single most important** reason for your choice to recycle with the Appliance Recycling Program? **[ALLOW ONLY ONE RESPONSE]**

D.5 PROGRAM RECOMMENDATION

P2. Have you recommended the Appliance Recycling Program to others?

1. Yes
2. No
98. Don't know

P3. **[IF P2 = 2 OR 98]** Using a scale of 0 to *10*, where 0 is "extremely unlikely" and 10 is "extremely likely," how likely are you to recommend the Appliance Recycling Program to a friend? **[RECORD A WHOLE # 0-10; DON'T KNOW = 98; REFUSED = 99.]**

D.6 DEMOGRAPHICS

We just have a few more questions for you. Please keep your primary address in mind while answering the remaining survey questions.

D1. What type of home do you live in? Please select one.

1. Single-family
2. Duplex
3. Triple decker (e.g., three-story house with each floor being a separate unit)
4. Apartment/condo in a 2–4-unit building

5. Apartment/condo in a 5+ unit building
6. Townhouse or row house (adjacent walls to another house)
7. Mobile home or trailer

97. Other, please specify: **[OPEN END]**

D2. Do you own or rent this residence?

1. Own
2. Rent

97. Other, please specify: **[OPEN END]**

D3. Counting yourself, how many individuals typically occupy this home? Enter zero if not occupied for at least six months of the year.

Occupant Type	**Number**
Adults, 18 and older	**[OPEN END; NUMERIC]**
Children, under 18	**[OPEN END; NUMERIC]**

D4. What is the highest level of education that you have completed so far?

1. Less than ninth grade
2. Ninth to twelfth grade, no diploma
3. High school graduate (includes GED)
4. Some college, no degree
5. Associates degree
6. Bachelor's degree
7. Graduate or professional degree

99. Prefer not to answer

D5. Which of the following best describes your age?

1. 18-24
2. 25-29
3. 30-39
4. 40-49
5. 50-59
6. 60-69
7. 70-79
8. 80-89
9. 90 years or older

99. Prefer not to answer

D6. **[IF D3 SUM OF ADULTS AND CHILDREN =1]** Which of these categories best describes your total household income in 2020 before taxes—counting everyone living in your house?

1. Less than **[IF STATE = CT DISPLAY "**$37,645**", IF STATE = RI DISPLAY "**$32,265**"] [GO TO CLOSING]**

2. **[IF STATE = CT DISPLAY "**$37,645**", IF STATE = RI DISPLAY "**$32,265**"]** or more **[GO TO CLOSING]**

99. Prefer not to answer **[GO TO CLOSING]**

D7. **[IF D3 SUM OF ADULTS AND CHILDREN =2]** Which of these categories best describes your total household income in 2020 before taxes—counting everyone living in your house?

1. Less than **[IF STATE = CT DISPLAY "**$49,228**", IF STATE = RI DISPLAY "**$42,193**"]** **[GO TO CLOSING]**
2. **[IF STATE = CT DISPLAY "**$49,228**", IF STATE = RI DISPLAY "**$42,193**"]** or more **[GO TO CLOSING]**

99. Prefer not to answer **[GO TO CLOSING]**

D8. **[IF D3 SUM OF ADULTS AND CHILDREN =3]** Which of these categories best describes your total household income in 2020 before taxes—counting everyone living in your house?

1. Less than **[IF STATE = CT DISPLAY "**$60,811**", IF STATE = RI DISPLAY "**$52,121**"]** **[GO TO CLOSING]**
2. **[IF STATE = CT DISPLAY "**$60,811**", IF STATE = RI DISPLAY "**$52,121**"]** or more **[GO TO CLOSING]**

99. Prefer not to answer **[GO TO CLOSING]**

D9. **[IF D3 SUM OF ADULTS AND CHILDREN =4]** Which of these categories best describes your total household income in 2020 before taxes—counting everyone living in your house?

1. Less than **[IF STATE = CT DISPLAY "**$72,394**", IF STATE = RI DISPLAY "**$62,048**"]** **[GO TO CLOSING]**
2. **[IF STATE = CT DISPLAY "**$72,394**", IF STATE = RI DISPLAY "**$62,048**"]** or more **[GO TO CLOSING]**

99. Prefer not to answer **[GO TO CLOSING]**

D10. **[IF D3 SUM OF ADULTS AND CHILDREN =5]** Which of these categories best describes your total household income in 2020 before taxes—counting everyone living in your house?

1. Less than **[IF STATE = CT DISPLAY "**$83,977**", IF STATE = RI DISPLAY "**$71,976**"]** **[GO TO CLOSING]**
2. **[IF STATE = CT DISPLAY "**$83,977**", IF STATE = RI DISPLAY "**$71,976**"]** or more **[GO TO CLOSING]**

99. Prefer not to answer **[GO TO CLOSING]**

D11. **[IF D3 SUM OF ADULTS AND CHILDREN =6]** Which of these categories best describes your total household income in 2020 before taxes—counting everyone living in your house?

1. Less than **[IF STATE = CT DISPLAY "**$95,560**", IF STATE = RI DISPLAY "**$81,904**"]** **[GO TO CLOSING]**
2. **[IF STATE = CT DISPLAY "**$95,560**", IF STATE = RI DISPLAY "**$81,904**"]** or more **[GO TO CLOSING]**

99. Prefer not to answer **[GO TO CLOSING]**

D12. **[IF D3 SUM OF ADULTS AND CHILDREN =7]** Which of these categories best describes your total household income in 2020 before taxes—counting everyone living in your house?

1. Less than **[IF STATE = CT DISPLAY "**$97,732 **", IF STATE = RI DISPLAY "**$83,765**"]** **[GO TO CLOSING]**
2. **[IF STATE = CT DISPLAY "**$97,732 **", IF STATE = RI DISPLAY "**$83,765**"]** or more **[GO TO CLOSING]**

99. Prefer not to answer **[GO TO CLOSING]**

D13. **[IF D3 SUM OF ADULTS AND CHILDREN >=8]** Which of these categories best describes your total household income in 2020 before taxes—counting everyone living in your house?

1. Less than **[IF STATE = CT DISPLAY "**$99,904**", IF STATE = RI DISPLAY "**$85,626**"]** **[GO TO CLOSING]**
2. **[IF STATE = CT DISPLAY "**$99,904**", IF STATE = RI DISPLAY "**$85,626**"]** or more **[GO TO CLOSING]**

99. Prefer not to answer **[GO TO CLOSING]**

D.7 CLOSING

[BASE: ALL]

CL1. **[IF STATE = CT]** Those are all the questions we have. Thank you for your cooperation. Please enter the email address to which you'd like us to send your $15 electronic gift card. **[ALLOW OPEN END RESPONSE] [CONFIRM E-MAIL ADDRESS]**

[IF STATE = RI] Those are all the questions we have. Thank you for your cooperation. Please enter the email address to which you'd like us to send your $10 electronic gift card. **[ALLOW OPEN END RESPONSE] [CONFIRM E-MAIL ADDRESS]**